GEOLOGY OF IO

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Geologic mapping of Io has been completed at 1:15,000,000 scale for an area lying between +40° and -90° latitude and 230° and 45° longitude, which includes portions of the Ruwa Patera quadrangle (Ji2) and the Lerna Region (Ji4) and the westernmost section of the Colchis Region (Ji3) (see Figure 1). Image resolution in the mapped area is commonly 0.5 - 2 km/pxl. High resolution areas (< .5 km/pxl) are located near the south pole (Lerna Region) and in eastern Ruwa Patera quadrangle. Geologic maps for the Ruwa Patera quadrangle (Ji2) [1] and the Lerna Region (Ji4) [2] have been produced at 1:5,000,000 scale. The present effort reexamines the previously mapped areas and synthesizes the geology of Io on a global scale.

Complications to mapping the surface of Io include: a lack of topographic information; the presence of SO_2 frost [3], dark mantling deposits [4], near surface gases [5], and eruption plumes [6] all of which obscure underlying materials; the coalescence of flows from adjacent vents; and the anastomosing of flows from single vents. In the present refinement of Io's geology an attempt has been made to associate volcanic flows with their source vent(s) and to provide a classification of volcanoes from which to analyze the roles of various styles of volcanism in the formation of Io's surface. Future work will extend the mapping and volcano classification into the less well imaged regions where possible to create the most complete representation of Io's surface.

The following materials were used to facilitate the production of the map: 1:15,000,000 shaded airbrush relief base maps of Io, 1:5,000,000 shaded airbrush relief maps of the Ruwa Patera, Lerna, and Colchis Regions, 1:5,000,000 geologic maps of the Ruwa Patera quadrangle [1] and the Lerna Region [2], Voyager photomosaics, Voyager images, and color photomosaics prepared by A.S. McEwen (Arizona State University and U.S. Geological Survey).

The surface of Io consists of volcanic vents and their associated deposits, plains, and mountains [7]. Fifteen geologic units have been defined to describe the types of materials composing these major physiographic terranes. Examination of the flow deposits associated with volcanic vents with regard to albedo, texture, surface morphology, and apparent relief suggests the following categories of flow materials: patera flows, plains-forming flows, lobate flows, breakout flows, tholi, shield materials [8], vent cone materials, and fissure flows. The plains are divided into interpatera plains and layered plains units, and the mountain materials include smooth and grooved units.

Although local stratigraphic relations are observed in many areas, development of global stratigraphy is extremely difficult due to the lack of topographic information and the absence of impact craters. Generally, the mountain and plains units appear to be older than vent and flow materials. In addition to the plume materials and frost present, low albedo vent and flow materials are apparently the youngest deposits on Io's surface. As is the case in terrestrial volcanology, the various types of volcanoes are observed in different stages of evolution and contrasting styles of volcanism can be associated with the same vent (e.g. -19°, 325°).

References

[1] Schaber, G., et al., 1985, in review. [2] Whitford-Stark, J., et al., 1985, manuscript. [3] McCauley, J.F., et al., 1979, *Nature, 280*, 736-738, [4] Carr, M.H., et al., 1979, *Nature, 280*, 729-733. [5] Lee, S.W., and Thomas, P.C., 1980, *Icarus, 44*, 280-290. [6] Strom, R.G., et al., 1979, *Nature, 280*, 733-736. [7] Schaber, G.G., 1982, *Satellites of Jupiter*, 556-597. [8] Moore, J., et al., 1986, *Icarus, 67*, 181-183.

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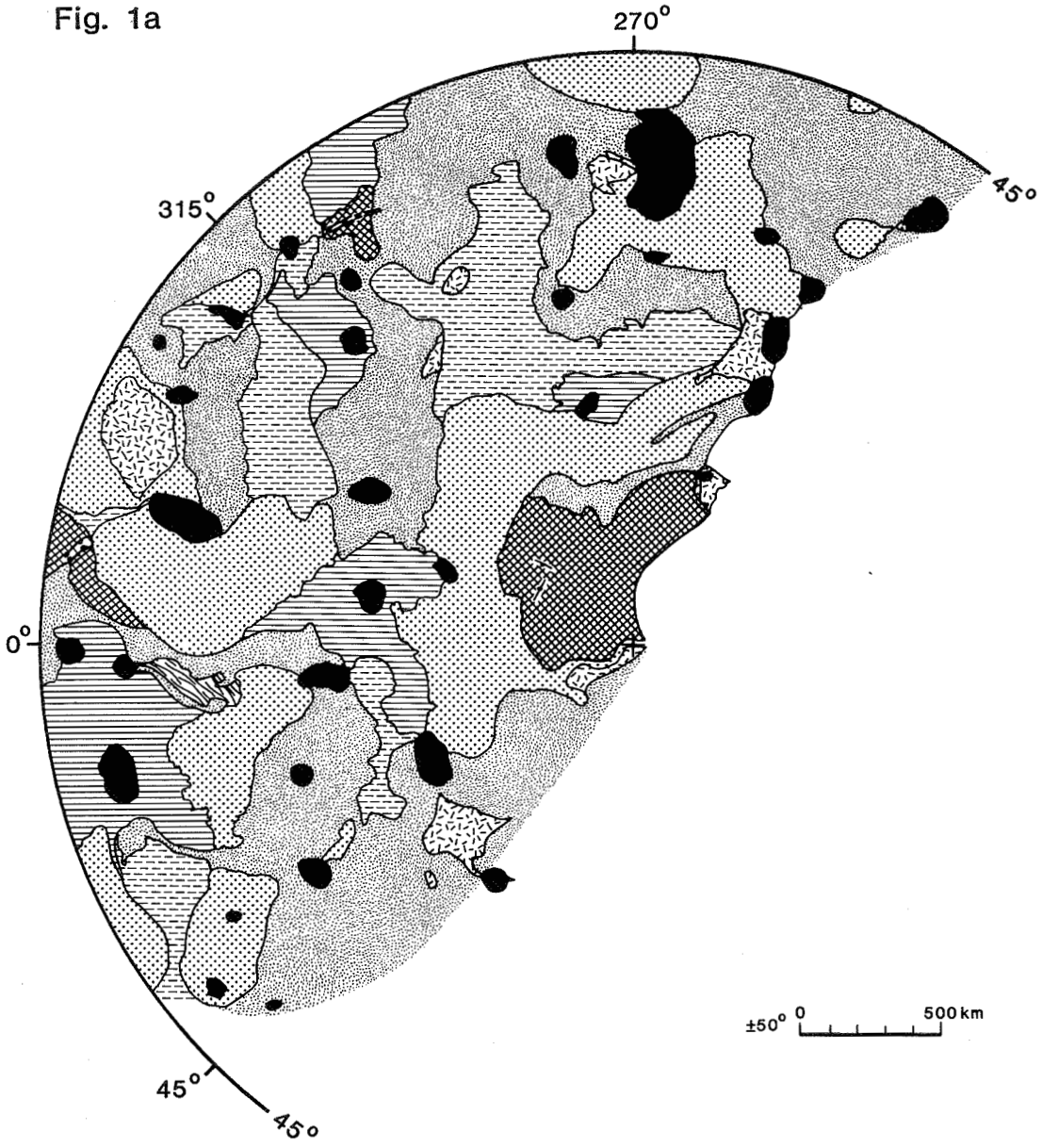
Fig. 1a



LEGEND

- contact
- volcanic fissure

PLAINS MATERIALS

- plains materials, intervent
- plains materials, layered

MOUNTAIN MATERIALS

- mountain materials

VENT FLOOR MATERIALS

- vent floor materials

FLOW MATERIALS

- flow materials, patera
- flow materials, plains-forming
- flow materials, lobate
- flow materials, breakout
- flow materials, tholus
- flow materials, shield
- flow materials, vent cone
- flow materials, fissure
- flow materials, undifferentiated

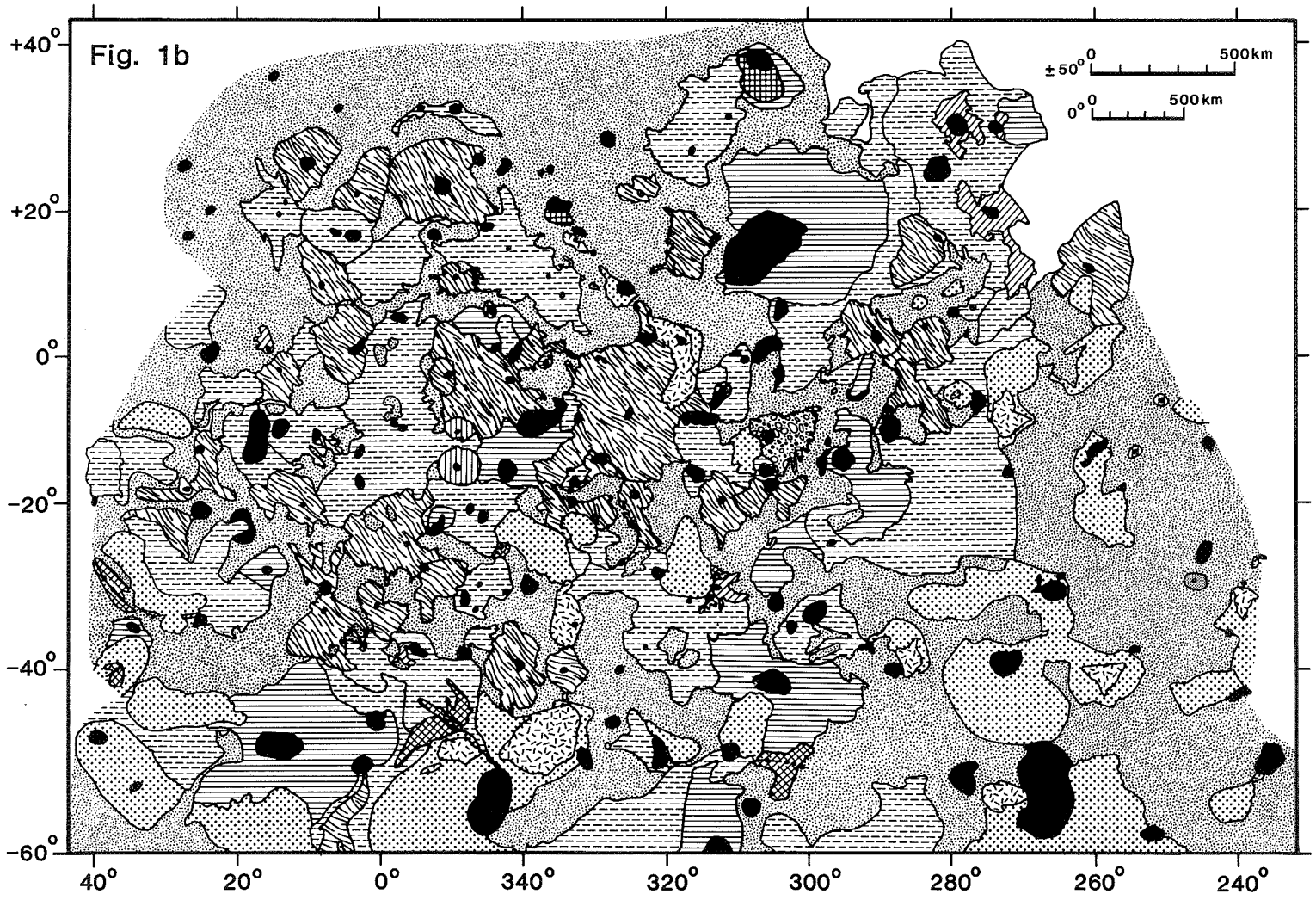


Figure 1. Preliminary geologic sketch maps of the polar (a) and equatorial (b) regions of Io as mapped on a 1:15,000,000 base. Major units are shown; however, structural features are not included.